

Development of Low-Toxicity Urine Stabilization for Spacecraft Water Recovery Systems

Niklas Adam¹, Julie L. Mitchell², Karen D. Pickering³
NASA Johnson Space Center, Houston, TX, 77058

Wastewater stabilization is an essential component of the spacecraft water cycle. The purpose of stabilizing wastewater is two-fold. First, stabilization prevents the breakdown of urea into ammonia, a toxic gas at high concentrations. Second, it prevents the growth of microorganisms, thereby mitigating hardware and water quality issues due to biofilm and planktonic growth. Current stabilization techniques involve oxidizers and strong acids (pH=2) such as chromic and sulfuric acid, which are highly toxic and pose a risk to crew health. The purpose of this effort is to explore less toxic stabilization techniques, such as food-grade and commercial care preservatives. Additionally, certain preservatives were tested in the presence of a low-toxicity organic acid. Triplicate 300-mL volumes of urine were dosed with a predetermined quantity of stabilizer and stored for two weeks. During that time, pH, total organic carbon (TOC), ammonia, and turbidity were monitored. Those preservatives that showed the lowest visible microbial growth and stable pH were further tested in a six-month stability study. The results of the six-month study are also included in this paper.

¹Water Hardware & Technology Chemist, Crew & Thermal Systems Division, M/S: EC3, not AIAA affiliated.

²Water Hardware & Technology Engineer, Crew & Thermal Systems Division, M/S: EC3, not AIAA affiliated.

³Water Hardware & Technology Group Lead, Crew & Thermal Systems Division, M/S: EC3, not AIAA affiliated.